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Shifts in Foliage Biomass and Its Vertical Distribution in Response to Operational Nitrogen Fertilization of Douglas-Fir in Western Oregon

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摘要 Nitrogen (N) fertilization is a commonly applied silvicultural treatment in intensively managed coast Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco var. menziesii) plantations. Field trials were established in a randomized complete block design by Stimson Lumber Company (Gaston, Oregon), to test the economic viability of N fertilization on their ownership and to better understand Douglas-fir growth responses. The 23 stands comprising the trials were Douglas-fir dominated, had a total age of 16–24 years, had been precommercially thinned, and had a density of 386–1021 trees ha?1. Fertilizer was applied aerially at a rate of 224 kg N ha?1 as urea during the 2009–2010 dormant season. In the dormant season of 2016–2017, seven growing seasons following application, 40 trees were felled and measured with the objective of assessing crown attributes and aboveground allometrics. Branch-level foliage mass equations were developed from 267 subsampled branches and were applied to the 40 felled sample trees on which the basal diameter and height of all live branches were measured, allowing estimation of both the total amount of foliage and its vertical distribution. A right-truncated Weibull distribution was fitted to data, with the truncation point specified as the base of live tree crown. The resulting tree-level parameter estimates were modeled as functions of tree-level variables. Stand-level factors not explicitly measured were captured through the use of linear and nonlinear mixed-effects models with random stand effects. Fertilization resulted in more total crown foliage mass in the middle crown-third and caused a downward shift in the vertical distribution of foliage, with implications for feedback responses in crown development and photosynthetic capacity. Defining the morphological responses of Douglas-fir crowns to nitrogen fertilization provides a framework for studying influences on stand dynamics and should ultimately facilitate improved site-specific predictions of stem-volume growth. View Full-Text

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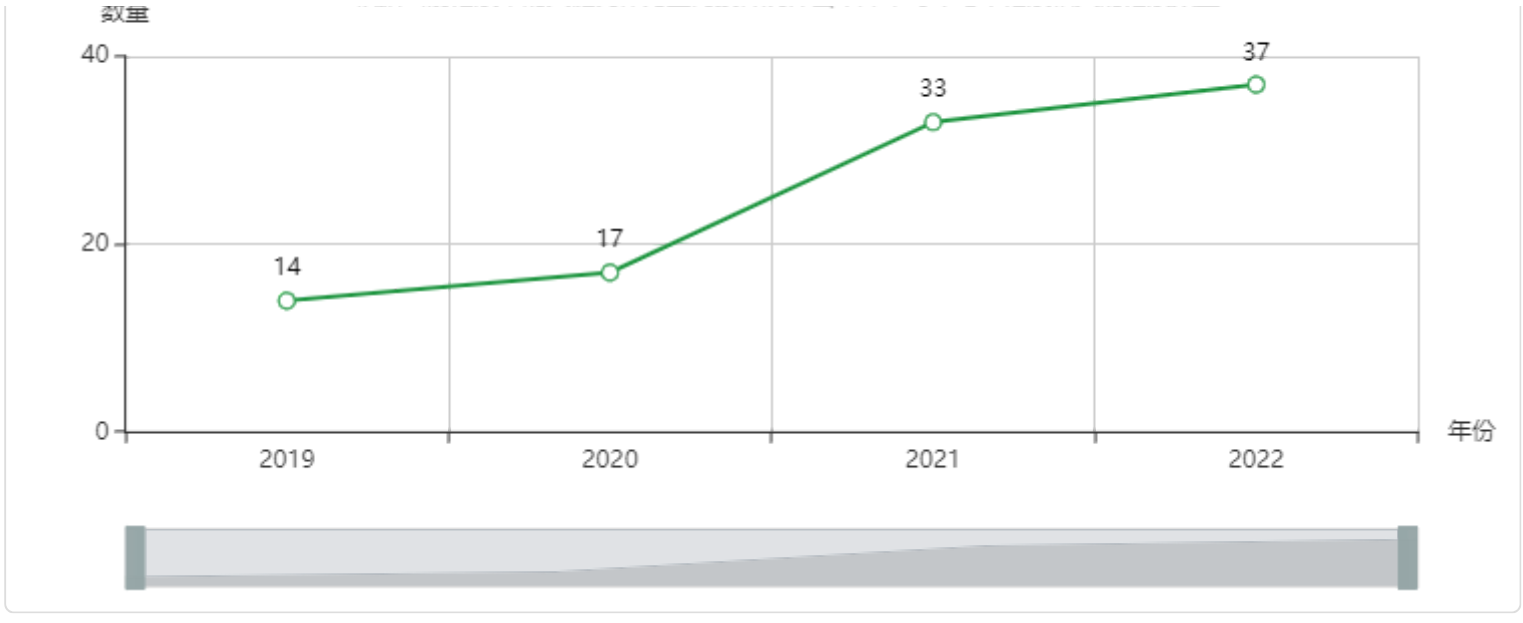
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